



IMPACT OF DEMOGRAPHIC CHANGES ON EQUITY RETURNS IN KENYA

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

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Date:

This Research Proposal has been submitted for examination with my approval as the Supervisor.

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List of Abbreviations

ARDL	Autoregressive distributed lag
CPI	Consumer price index
KES	Kenyan shillings
NSE	Nairobi Securities Exchange
NSE-20	Nairobi Securities Exchange 20-Share Index
U.S	United States of America
USD	United States Dollar

1) CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Economist have carried out research into the various ways in which demographic changes affect various macroeconomic factors such as inflation, aggregate consumption, savings, labor supply and social programs. However, dismal work has been done to determine the influence of changing demographic structures on stock prices and rates of return which eventually leads us to ask the magnitude of significant changes in demographic structure on stock market performance.

The relationship between equity returns and demographic changes can be traced back to the entry of the “baby boomers” generation in the United State, those born within two decades after the end of World War II, who reached their peak saving years in the 1990s. With most people being between aged 35-55 years (the active ratio of the population) the savings rate was high and aggregate demand increased making these one of the causes associated to high stock returns and growth in stock returns within that period as postulated by Chen and Gurdip (1994).

The U.S experienced an unprecedented shift in demand for particular goods and services which influenced investor’s preference for particular assets which were previously not popular. The baby boomers were the first generation of children and teenagers with significant spending power which caused a positive shift in demand for consumer and investment products. The latter combined with their numbers fueled the growth of massive marketing campaigns and an introduction of a wide range of new products and technology which targeted the baby boomers lifestyle: Fashion, education, entertainment, housing and other luxury products.

The world has gradually been moving from a state of short life spans and high fertility rates to one of longer lives and lower fertility rates. These demographic transitions have been altering the age structures of populations. Eventually, the world is expected to be characterized by few births per woman, long life expectancies, and population structures with large proportions of middle aged and elderly individuals and smaller proportions of children. These has seen changing preferences for consumer products and investments as the average age of the population increases.

A study by Ameriks and Zeldes (2004) asserts that often the fraction of wealth that people should hold in the stock market should decline with age. It is a typical rule of thumb that the percentage

of an investor's portfolio that is held in equities should equal 100 minus their age such that a 30-year old would hold 70 percent of their financial wealth in stocks while a 70-year old would hold 30 percent in stocks . This proposition is supported by Chen and Gurdip (1994) whose study brings forth the life cycle investment hypothesis and the life cycle risk aversion hypothesis to explain changes in preferences with advancing age.

The debate on whether demographic changes affect asset markets has drawn interest over the past two decades after a the baby boom in the U.S. Concern has been raised on the stability of the stock market when the demographic structure of a country changes over time without prior formulation of policies that prepare for such a shift. For example, Poterba (2001) raises concern on the burden the economy would face as the baby boom cohort began to reach retirement such as increased social security and Medicare expenditure and a supply glut in the capital market when the cohort starts drawing down their wealth. Proliferation of such ideas has drawn interest among academic economist who would like to establish the behind such perceptions.

1.2 Motivation of the Study

Unprecedented changes in demographic structure can have significant impact on real economic activity and more so the capital market. For example; the baby boom era in the U.S, after World War II, was accompanied by a general rise aggregate demand causing an increase in aggregate supply in the economy. On the contrary, Poterba (2001) asserts that the entry of this large cohort into the labor market may have been associated with an increase in aggregate unemployment rate. While it is difficult to state with certainty the casual relationship between an increase in population and equity returns, there is evidence that shifts in demographic structure can be associated to changes in stock returns. According to Chen and Gurdip (1994) a rise in the average age tends to be followed by a rise in the market premium. They attribute this to the life cycle risk aversion hypothesis.

In Kenya, no exact relationship has been traced between the Kenyan demographic structure and stock returns. However it is possible to infer literature from studies conducted in other jurisdictions such as the U.S since Kenya is experiencing a rapid increase in population and consistent rise in aggregate demand. The study by Obere and Thuku (2013) asserts that there exists a long-run relationship between population and economic growth in Kenya. With their results indicating a positive correlation between population and economic growth in Kenya they support the hypothesis that population is driving economic growth in Kenya.

1.3 Problem Statement

There exists a gap in defining the relationship between demographic changes in Kenya and equity prices with most studies focusing on the general macroeconomic factors and their responses to the latter. For example, Thuku and Obere (2013) assert that the relationship between population and economic growth is strong and positive in Kenya. In their findings they state that Kenya is in its second stage of demographic transition, called Malthusian regime, in which the relationship between economic growth and population growth remains highly strong and positive. Their findings support the population-driven economic growth (gross domestic product) hypothesis which contends that the population growth in a country promotes its economic development.

The study by Chen and Gurdip (1994) uses a multiple regression model with key market factors in the U.S and population parameters to examine the effects of the baby boom cohort to the capital markets as they age. Their findings are centered on risk aversion and investment choices which they stipulate change considerably as a person ages and therefore a large cohort would affect asset prices and return dynamics. This study uses regression and ARDL modelling techniques to examine the effects of demographic transition on equity prices.

1.4 Research Objectives

The objective of this study is as follows:

- 1) To establish if there is a significant relationship between demographic changes and equity prices.

1.5 Research Hypothesis

The research hypotheses are:

H_{01} : Changes in demographic structure have no significant effect on equity returns.

H_{A1} : Changes in demographic structure have a significant effect on equity returns.

1.6 Importance of the Research

The goal of this research is to establish whether changes in the proportion of the working and retired population can cause a significant effect on the prices of equities in Kenya. Understanding investment preferences of the majority cohort in the population is an important factor in determining whether their investment decisions in capital markets therefore affect equity prices. This research has been intensified by the recent rise of prices in real estate assets fueled by a rising middle class whose demand for housing has increased. In this study, the aim is to establish whether a large cohort can affect equities based on their investment decisions and mainly the proportion of those who are working against the retirees. Having comprehensive understanding of this will enable stakeholders to model investments that suite the preferences of the population considering demographic aspects of that population.

2) CHAPTER 2: LITERATURE REVIEW

2.1 The Life Cycle Hypothesis

The life cycle hypothesis asserts that individuals try to maximize their utility by balancing a lifetime stream of earnings with a lifetime pattern of consumption, Ando & Modigliani (1963). This theory asserts that consumption and income are unequal at various points of individuals' life. Younger people tend to have consumption needs that exceed their income or savings. Their needs tend to be mainly housing and education. In the middle-age earnings generally raise enabling debts accumulated earlier in life to be paid off and savings to be accumulated. Finally, in retirement incomes decline and individuals consume savings previously made.

Most investments are made in the middle-age period and this is where the focus on investment is placed (Gurdip S. Bakshi, 1994). This is because most individuals have incomes surpassing their consumption. Investments taken up will depend with the level of income but just to list a few preferred: real estate, bonds, stocks, agriculture and retail trade.

Investments in the capital markets are currently the best example of savings with pension schemes, insurance companies and investment banks being the largest investors of savings made by individuals to these institutions. Individuals save in these institutions by taking up savings or investment products such as endowment policies, retirement packages, unit trusts and life assurance covers. These funds are then pooled by respective companies and invested in various sectors across the economy with the capital markets being the main recipient of funds.

Older persons establish a claim to future stream of income payments that is generally a function of each person's earnings history and life expectancy. Individuals therefore draw from their pension wealth by receiving pension payments in retirement.

Assuming there is significant increase in population growth, eventually there will be a surge in the middle-age population. At a certain point in time the economy will experience increased savings and therefore investments attributable to high number of people within the income bracket. This will drive up economic activity with time since there will be more wealth being created brought about by increased demand for goods and services. Part of this wealth will be

saved for retirement and for future income. Therefore the amounts being channeled to potential investments will increase and therefore forcing prices of assets up.

Once this population grows into retirement, saved funds will be drawn for consumption and in case the population growth was not even there may be increased consumption surpassing the level of savings. At this point assets which are held by retirees will be sold off or stored proceeds drawn. These withdrawals will reduce the level of investments and will also see security prices decline with time as most investors fuel consumption by disposing sellable assets, (Poterba, 2001).

Chen and Gurdip (1994) claim that older age groups are major market participants with an estimated 53% of all interest, dividend, real estate incomes and a third of all capital gains in the United States being received by the group of people aged 65. Incomes received by this group have been rising steadily over time since 1970. This makes it quite clear that an increasingly larger portion of the nation's wealth is held by the older age group. What actually interests them is the investment behavior of the older group as it is different from the younger group and therefore asserts the age distribution will have significant impact on capital market prices.

2.2 Economists Perspectives on the Life Cycle Hypothesis

Chen and Gurdip (1994) studied capital markets by examining two hypotheses: the life cycle investment hypothesis and the life cycle risk aversion hypothesis. The life cycle investment hypothesis simply states that at different stages of an investor's life cycle the investment needs vary. He uses the example of investors in their 20s and 30s who will probably allocate a higher proportion of wealth to housing and other durable but as the investors grow older, the need to invest for retirement increases. If this hypothesis is true, it implies that as the population ages, the aggregate demand for housing decreases thereby depressing housing prices while that for financial investment such as equities drives up financial prices.

The life cycle risk aversion hypothesis is more relevant to this topic as it tries to explain changes in risk premiums, which is an important factor of equity return, as investor's age. The life cycle risk aversion hypothesis asserts that investors relative risk aversion increases with age and therefore equilibrium market risk premiums should be correlated with demographic changes in the age of the "average" or "representative" investor.

Besides, these two hypotheses highlight that demographic changes can influence capital markets in other ways such as an increasing need to raise social security, Medicare and other social programs due to an aging population. To meet such increased obligations, the government will increase taxes or finance it through debt and companies will be at a position to set aside more revenues to settle pension obligations as opposed to taking up more capital investments with the funds. The overall effect of an increasing average age of the population will be an increase in people who will draw away funds for consumption than those building up capital. This will result in an increase in cost of capital for productive investment.

Chen and Gurdip (1994) recognizes that in fact a population with many people in the older age will pile pressure on the government and companies to allocate more funds to pensions, Medicare and social security however I am opposed to the fact that all these drawings will be lost in consumption. A considerable portion of these funds will be channeled to the capital markets as pension funds and from other financial intermediaries such as insurance companies that deal in life assurance covers. However, there will be a drop in investments if this age group is not replaced by an active working ratio consisting of young people.

Angela & Ang (2003) investigated the link between demographic changes and equity risk premium across developed markets. Their demographic variables comprised: average age of population above 20 years, fraction of adults over 65 years and proportion of population in the working age of 20-65 years. Basing their studies in the U.S and fifteen over developed countries, they find that changes in these demographic variables, an increase in the average age of the population, do affect equity risk premiums in an inverse relationship. However, they note that variables affecting equity premiums in one country are different from those affecting equity premiums of another country.

The most powerful predictive demographic variable, according to Maddaloni and Andrew (2003), associated to variations in excess returns (compensation above the risk free rate) is the change in the proportion of retired people as a fraction of adult population. He supports Chen and Gurdip (1994) argument of the life cycle investment hypothesis which acknowledges that investment needs of a person at different stages of the life cycle vary. They assert that a growing proportion of retired people significantly forecasts increases in equity premiums translating to increased expected rates of return on stocks. They also avow that demographic predictability of

risk premiums by changes in the proportion of retirees is strongest for countries that have high allocations to social security and for countries with a less developed financial system.

The asset price meltdown hypothesis states that when baby boomers retire, they will reduce their holdings as they seek to consume what they had invested earlier and a change in expectations coupled with risk tolerance. Therefore asset prices will be adversely impacted. However, I decline to support this argument. Asset holdings rise sharply over the peak saving years of a population. They fall slowly when the ageing retire and there for instead of a sharp decline in asset prices. The decline will be gradual and if the middle-age is able to retain or surpass the saving rate of the older population then there may not be any considerable impact on asset prices.

The life cycle theory of saving set forth by Modigliani and Brumberg (1954), asserts that the primary objective of a consumer is to retain an optimal consumption decision over time so as to maximize his overall lifetime utility. Chen and Gurdip (1994) hypothesize that when allocating savings between financial assets and housing, an investor will be willing to put relatively more savings in housing during his first part of the life cycle. However, as the investor grows older, he has probably acquired sufficient housing and the urgency to cope with uncertainty of remaining lifetime income becomes prominent. This creates a greater need to invest for retirement, which in turn requires the aging investor to put an increasing proportion of income into financial assets. With life expectancy expected to increase due to medical advances, this makes it more necessary to invest in retirement. Thus the demand for financial assets increases with age while that of housing decreases. This demand puts pressure on prices for security returns making them increase over time especially if the population is dominated by the older age group.

According to Chen and Gurdip (1994) who look at the life cycle risk aversion hypothesis, the investor's human capital is an approximately decreasing function of age. They assume that the paycheck of most individuals decline with age and if this is true an investor will not be willing to take on a lot of financial risk since there will be fewer opportunities to use their labor income to cover potential losses. In addition as life expectancy increases one's lifetime becomes more uncertain, a typical investor will not be willing to increase his risk tolerance. This will be reflected in the equity risk premium where an upward shift will be evident if the greater part of the population is of older age. To be able to take on financial assets, the investors will require a

greater risk premium to suite their level of risk aversion. This on the other hand will increase the expected return of securities and therefore leading to lower prices of the latter.

According to Poterba (2001) that the baby boomers will have no one to sell their assets to once they reach retirement and begin to draw their wealth. He asserted that with a declining population growth rate after the baby boom, the baby boomers would have a difficult time trying to sell their assets. This would be a great threat to the prices of financial assets held by baby boomers and for the economic health. Scheiber and Shoven (1997) develop a similar argument in their analysis of the link between demographic structure and the pattern of inflows and outflows from defined benefit pension plans. According to Scheiber and Shoven (1997) when the pension system begins to be a net seller of assets this could depress asset prices.

In a study conducted Poterba (2001) incorporates both risky and riskless assets in his model so as to explore how demographic shocks affect the risk premium. Rapid population growth that persists for at least half a generation and that is followed by below average population growth affects the equilibrium level of both risky and riskless asset returns. The riskless return rises when the baby boom generation is young and working and it falls by roughly the same amount when the large cohort reaches retirement age, because older households prefer riskless to risky assets. Equilibrium returns on the risky asset change by roughly half as much as the riskless return, so the equilibrium equity risk premium declines in the early stages of the baby boom.

3) CHAPTER 3: METHODOLOGY

An ARDL model will be used with the Error Correction Model (ECM) in this model being estimated and the long run coefficients will be tested for presence of cointegration. The ARDL model is considered to account for long-run relationships between variables which is consistent with testing cointegration between changes in aspects of the population and equity returns. The rationale of choosing ARDL for this study is based on a few advantages ARDL is argued to have over conventional Johansen cointegration techniques.

The ARDL is statistically a significant approach for determining cointegrating relationships in small samples. Besides, another advantage of ARDL is that while other cointegration techniques require all of the regressors to be integrated of the same order, the ARDL can be applied whether regressors are $I(0)$ or $I(1)$: Whether results are non-stationary or stationary or if mixed results are obtained.

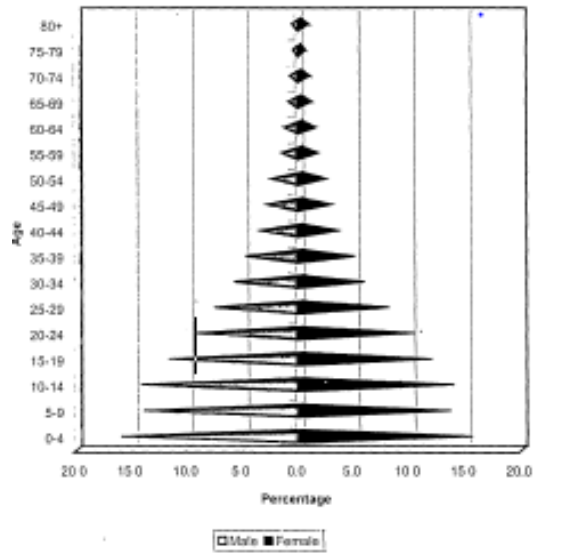
3.1 Research Design

The research design used in this proposal is descriptive. This is because the study aims to observe the behavior of equity returns as demographic structure changes and establish whether there is a long-run relationship. The study takes into account changes in equity returns over a specific time period and regresses these returns against changes in demographic structure, average working population and the average population of the retired, over the similar time period. Finally the study conducts tests for long-run relationship and cointegration are conducted on the model to examine the later.

3.2 Population and Sampling

The population used in this research is the Kenyan population and NSE 20 share index data. The data on population will be selected from estimates of the Kenya census from which annual estimates of population made using annual population growth estimates. The population estimates will be acquired from the 1999 census and out of the 17 age-groups with an age span of four years between them as shown in the figure below.

Figure 1: 1999 Population Pyramid



Source: The 1999 Population and Housing Census: Volume 1, January 2001..

However, only the population estimates of persons aged between 20-55 years (grouping 7 age groups) and those aged above 60 years will be considered.

The NSE 20 share index will be used as the stock market sample to measure equity returns. The NSE 20 index is selected over the all share index since it is more accurate and representative of the underlying market position, Osoro and Ambrose (2013).

The macroeconomic variables used in this study include inflation rates, interest rates (91 day Treasury bill rates), exchange rates (USD/KES) and oil prices. Stock prices are greatly affected by investor expectations to any publicly disclosed information such as economic or political views. It is therefore important to analyze stock prices using indicators which measure changes in expectations about future values of macroeconomic factors Dubravka and Posedel (2010). A study by Simon (2015) on the Kenyan securities exchange finds that stock market performance is affected by changes in macroeconomic variables: to carry out the study he uses interest rates, inflation rate, exchange rates and money supply.

3.3 Method Specification

An Autoregressive distribution lag (ARDL) model to incorporate, the working ratio of the population and the retired segment using three population proportions (25-39, 40-59 and 60-79), demographic variables which will represent the population cohorts that affect the movement of equity prices over time.

Demographic changes will be measured by changes in the average working population (population of persons aged 25-39 years and 40-59 years) and the average population of retired persons (above 60 years). The population proportions of these cohorts will be computed with respect to total population. Annual forecasts will be obtained by interpolation based on the 1989, 1999 and 2009 population census count and respective annual population growth rates.

3.4 Data Type and Sources

NSE 20 returns will be used as indicators of equity returns. Data on the NSE 20 share index will be obtain from the NSE website. The study will also use macroeconomic data which will include annual gross domestic product values, inflation growth rates and interest rates. The 91-treasury bill rate will be annualized to allow its application in analysis. This has been selected over the CBR and the repo rate as it the most commonly viewed rate by market participants used to formulate market expectations and significantly affects portfolio allocations between bonds and equities. Data on equity prices will be acquired from Nairobi Securities Exchange archives while macroeconomic data will be obtained from the KNBS annals.

Demographic variables will be represented by the proportion of the working population and the retired cohort. Data on these variables will be acquired from KNBS archives. Annual population growth rates will be used to build annual estimates of population variables from 1989 to 2015.

3.5 Data analysis

Before proceeding to the ARDL bound test, there is need to test for stationarity status of variables to determine their order of integration so that we do not include I(2) integrated variables which will invalidate the methodology when included. This is to ensure that we do not generate spurious results Oteng and Magnus (2006).

3.5.1 Unit Root Tests

As earlier stated, unit root tests are mainly a descriptive tool performed to classify data as stationary or non-stationary. Determining whether data is non-stationary will be important in studying the behavior in the time series data over the time in consideration.

3.5.1.1 Augmented Dickey-Fuller Test (ADF)

The test is conducted by augmenting the preceding equations (1.1 and 1.2), by adding lagged values of the dependent seasonal, Gujarati (2004). The ADF test adjusts the DF test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand.

The ADF test here will consist of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{t=1}^m \alpha_t \Delta Y_{t-1} + \varepsilon_t \quad (1.1)$$

Where ε_t is the error term and where $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ and $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$ e.t.c. The number of lagged difference terms to include is determined empirically with the aim being to include enough terms so the error term is serially uncorrelated.

When conducting the test the null and alternative hypothesis will be as follows:

$$H_0: \delta = 0$$

$$H_1: \delta < 0$$

The value of the test statistic will can then be computed as:

$$DF_T = \frac{\delta}{SE(\delta)}$$

If the test statistic is less than the critical value for the dickey fuller test, then the null hypothesis $H_0: \delta = 0$ is rejected and no unit root is present. It can be concluded that the data is stationary. All variables that will be I(2) integrated will be dropped from the model.

3.5.2 ARDL Cointegration Approach

To analyze the long-run relationships and dynamic interactions among demographic variables and equity prices, the model will be estimated using bounds testing or autoregressive distributed lag (ARDL) cointegration procedure, developed by Pesaran, Shin and Smith (2001). The procedure allows inferences on long-run estimates to be factored into the model. It accommodates a greater number of variables and can be applied regardless of the stationary properties of the variables being used, Hassan and Mueen (2008) and Magnus and Oteng (2006).

IR, CPI, ER and OP will be used to represent interest rates, consumer price index, exchange rates (KES/USD) and oil prices respectively.

LP(lower proportion), MP(middle proportion), RP(retired proportion) will be used to represent 25-39 year, 40-59 year and 60-79 year proportions respectively.

First, the ARDL form of equation is formulated with an error correction term as follows:

$$\Delta SMI = \alpha_0 + \sum_{i=0}^T \vartheta_i \Delta LP_{t-i} + \sum_{i=0}^T \alpha_i \Delta MP_{t-i} + \sum_{i=0}^T \pi_i \Delta RP_{t-i} + \sum_{i=0}^p \beta_i \Delta IR_{t-i} + \sum_{i=0}^q \gamma_i \Delta CPI_{t-i} + \sum_{i=0}^R \varphi_i \Delta ER_{t-i} + \sum_{i=0}^S \omega_i \Delta OP_{t-i} + Z_t + \varepsilon$$

Where Z_t is the error correction term such that; $Z_t = \theta_1 LP_{t-1} + \theta_2 MP_{t-1} + \theta_3 RP_{t-1} + \theta_4 IR_{t-1} + \theta_5 CPI_{t-1} + \theta_6 ER_{t-1} + \theta_7 OP_{t-1}$

Z_t can be defined as the OLS residual series from the long run cointegration regression:

$$SMI = \beta_0 + \beta_1 LP + \beta_2 MP + \beta_3 RP + \beta_4 IR + \beta_5 CPI + \beta_6 ER + \beta_7 OP$$

The parameter θ_i , where $i = 1, 2, 3, 4, 5, 6, 7$ is the corresponding long-run multipliers, whereas $\vartheta, \alpha, \pi, \beta, \gamma, \varphi, \omega$ are short-run dynamic coefficients of the underlying ARDL model.

The ranges of the lags in the equation will be determined using Schwarz information criteria (SIC) as it is a consistent model selector.

To test for the existence of a long run relationship among the variables the bounds test will be used with the null hypothesis being:

$$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = 0$$

Pesaran *et al* (2001) publishes tabulated asymptotic critical value bounds for the F-statistic. If the computed F-statistic falls outside the critical value bounds, the test allows a conclusive inference without needing to know the integration status of the underlying regressors. But if the F-statistic falls within the bounds inference is inconclusive and knowledge of the order of integration of the underlying variables is required before conclusive inferences are made. Therefore if the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected and if the statistic falls between the lower and upper critical values, the result is inconclusive.

4) CHAPTER 4: DATA ANALYSIS

4.1 Unit Root Test

The study begins with testing the variables for stationarity. The results using the Augmented

Variables	UNIT ROOT TEST RESULTS								
	Level	1st difference			2nd difference				
	T-Statistic	Critical Values 1%	P-Values	T-Statistic	Critical Values 1%	P-Values	T-Statistic	Critical Values 1%	P-Values
LN_CPI	-2.2584	-3.6999	0.1919	-3.0647	-3.7115	0.0067	-6.2226	-3.7518	0.2156
91day Tbill	-1.5761	-3.6999	0.4807	-9.884	-3.6999	0	-	-	-
LN_Oilprices	-1.1062	-3.6999	0.6984	-4.7965	-3.7115	0.0007	-	-	-
LN_ExchangeR	-0.3701	-3.6999	0.901	-3.1004	-3.6999	0.0385	-6.2203	-3.7115	0
LN_Pop. 25-39	-1.0959	-3.7241	0.071	-4.6485	-3.7241	0.0011	-	-	-
LN_Pop. 40-59	-0.1178	-3.7241	0.937	-3.933	-3.7241	0.0062	-	-	-
LN_Pop. 60-79	-3.0824	-3.7241	0.041	-3.0824	-3.7241	0.041	-3.9266	-3.7379	0.0065

While carrying out this test the null hypothesis was that the data set has a unit root (is non-stationary) while the alternative hypothesis would be that the data set does not have a unit root and therefore is stationary. The purpose of this section is to ensure that we do not work with I (2) in our ARDL model.

Data on population proportion for the 25-39 year and 40-59 year cohort was found to be stationary after taking first differences, while data on the 60-79 year cohort was found to be stationary after 2nd differencing. Therefore we will not include this cohort as it is I (2).

The data on both consumer price index and exchange rates were stationary after taking second differences of the respective data. Data on oil prices and the 91 day T-bill rates were found to be I (1). This implies that CPI and data on the USD/KES exchange rate will be excluded from the ARDL model.

4.2 ARDL Approach to Cointegration

In this section the ARDL form equation is estimated using all variables selected in section (4.1). The bounds test will then be performed on the estimates derived to establish whether there is a long run relationship between the explanatory variables and the dependent variables.

The results of the ARDL regression are as follows:

Variable	Coefficient	Std. Error
<i>NSE20_R(1)</i>	0.06627*	0.2198
<i>LN25-39(0)</i>	1.68907	0.3529
<i>LN40-59</i>	1.3224*	0.5686
<i>91day Tbill R</i>	0.0082**	0.0092
<i>C</i>	0.7142	0.8535
<i>R-Squared</i>	0.4689	

The model selected in this ARDL form equation using Schwarz criterion is (1,0,2,0,0) for the respective variables listed above i.e. the number of lags selected for each variable in the final equation is (1,0,2,0,0).

The coefficient of the 25-39 population proportion (1.68907) is significant at 10% level of significance and has a positive effect on returns which implies that an increase in this population cohort has a positive effect by increasing return. This population cohort is also significant to explaining returns since the P-value associated with its coefficients is smaller than 0.25.

The 40-59 population proportion also has a positive relationship with return and is significant at a 5% level.

T-Bill rates have a positive effect on returns on the NSE 20 index as derived from their coefficients 0.0082 at a 5% level of significance.

4.3 Bound Tests

The bounds test is carried out for the ARDL coefficient estimates obtained in section (4.2) to establish whether there is any cointegrating relationship between the variables. An F-statistic is calculated and compared to the lower bound $I(0)$ and upper bound $I(1)$ of the critical values tabulated by Pesaran *et al* (2001).

Null Hypothesis: No long-run relationship exist		
Test Statistic	Value	K
F-statistic	5.194737	4
Critical Value Bounds		
Significance	0 Bound	1 Bound
10%	2.2	3.09
5%	2.56	3.49
2.50%	2.88	3.87
1%	3.29	4.37

The value of our F-statistic is greater than all |1 bound critical values. Therefore we can reject the null hypothesis and accept the alternative that the explanatory variables cointegrated with the dependent variable. This would go further to imply that changes in the population cohort aged 25-39 years and 40-59 years covary with changes in NSE 20 returns over time. It would then be important to estimate the long-run and short-run relationship within the model. This will be carried out by estimating the Error Correction Model (ECM) of the ARDL form.

4.4 ECM in ARDL Form

The ECM to be estimated is as follows:

$$\Delta SMI = \alpha_0 + \sum_{i=0}^T \vartheta_i \Delta LP_{t-i} + \sum_{i=0}^T \alpha_i \Delta MP_{t-i} + \sum_{i=0}^p \beta_i \Delta IR_{t-i} + \sum_{i=0}^s \omega_i \Delta OP_{t-i} + Z_t + \varepsilon$$

Where $Z_t = \theta_1 LP_{t-1} + \theta_2 MP_{t-1} + \theta_4 IR_{t-1} + \theta_7 OP_{t-1}$

The equation Z_t represents the long-run coefficients of the model while the short-run coefficients are represented in the ECM with their respective lags. The aim is to establish the relationship between the individual explanatory variables and the dependent variable.

Table 2:

Variable	Coefficient	Std. Error
NSE20_R(2)	0.79005*	0.2725
LN25-39(0)	0.44516	0.0889
LN40-59(1)	0.0781**	0.9152
91day Tbill R(2)	-0.0062	0.0033
NSE20_R	0.06627*	0.2198
LN25-39	1.68907	0.3529
LN40-59	1.52441*	0.5686
91day Tbill R	-0.0082	0.0092
C	0.7142	0.8535
R-Squared	0.5689	

The long run form coefficients are represented by the variables **LN25-39**, **LN40-59** and **91dayTbill R** in table 2. The coefficients of **91day Tbill R** and **LN40-59** are significant at 5% and 10% level of significance respectively whereas **LN25-39** is insignificant at all levels of significance. This postulates that the **LN25-39** population proportion is not significant both in the short run and in the long run in affecting returns derived from the NSE 20.

A unit change in the 25-39 population proportion would be expected to cause a 1.689 change in returns, however, it has been established that this population proportion is not significant in predicting returns. A unit change in the 40-59 population proportion is expected to cause a 1.5244 change in returns with a 10% level of significance. The results show that the 91 T-bill rates affect returns positively i.e. an increase in the T-bill rate will increase returns for the NSE 20 equities.

5) CHAPTER 5: CONCLUSION

Most of the macroeconomic variables selected for this study are relevant for explaining changes in returns in the NSE 20 with oil prices being the exceptional variable. In all regression models that have been estimated oil prices have shown to be insignificant in explaining changes in NSE 20 returns. This is however surprising since oil is a major import affecting prices of consumer goods due to its reliance in transport and production processes.

The data on population is seen to be increasing with time. This increase is attributable to increasing population growth rates over time with improved health care in the country which has also contributed to low infant mortality rates.

The study finds that the population proportions of all population cohorts in the model are relevant to explaining changes in the NSE 20 returns. However, the model with the 40-69 year cohort has a higher explanatory power over returns followed by the 60-79 year cohort model and the regression model with the least explanatory power over NSE 20 returns is 25-39 year cohort.

This finding is consistent with Ando and Modigliani (1963) life cycle hypothesis is that at the middle age is when most savings are made in a person's human cycle. Therefore an increase in this population proportion will increase the amount of savings with most if these savings being directed to the stock market through pension funds, insurance companies, investment funds and other financial institutions such as banks. However, our results are not consistent with the theory that at retirement people there will be dissaving as people in retirement seek to spend the savings they made in their middle age. This would imply that our coefficients would be negative as to show decreasing return as this population cohort increases.

This study finds that changes in population size have an effect on the rate of returns in the NSE 20. However, this is dependent on the population cohort that constitutes the highest proportion in the population. This will then affect the level of savings in the economy besides consumption preferences brought about by level of disposable incomes.

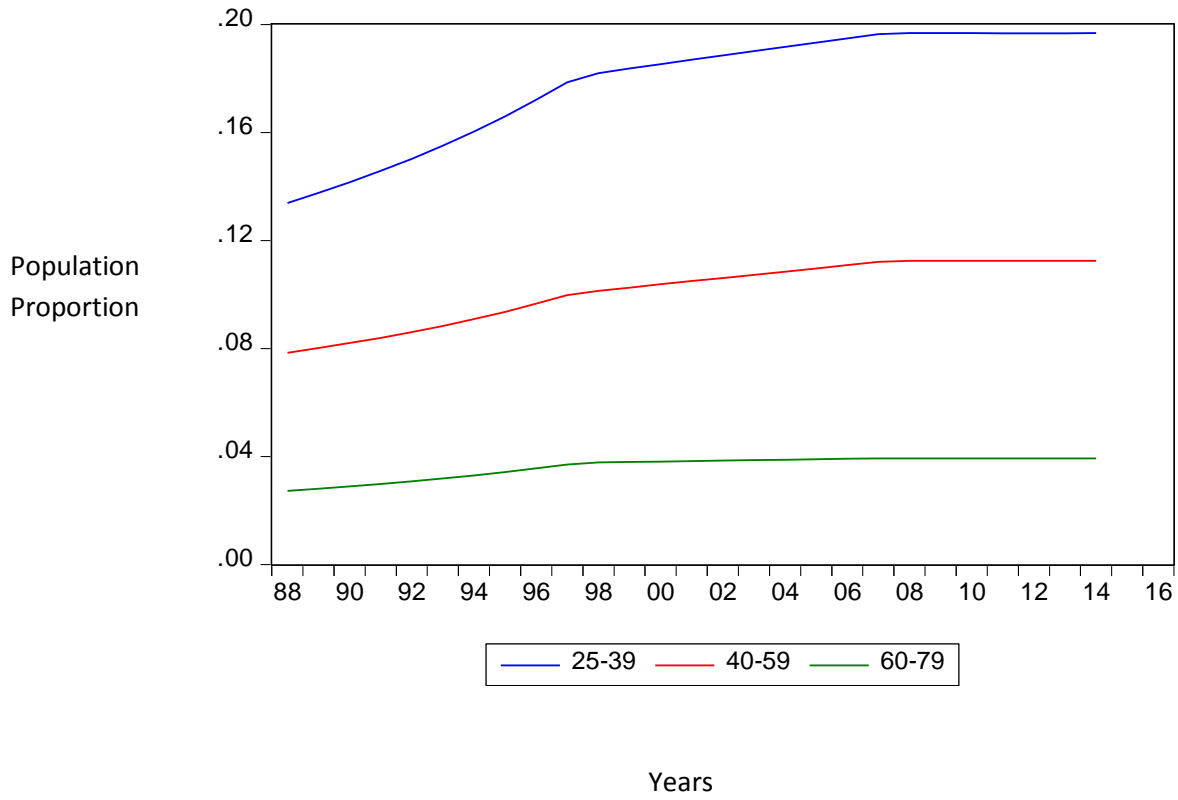
5.1 Implication of the Study

The demographic structure of a country can have effects development, governance, environment, climate change and gender equality among other factors. This study focuses on the effect of demography, as characterized by age structure and size of the population, on equities. According to Elizabeth *et al* (2010) demography is one of the most important factors of development in a country and in particular the youth are one of the main economic assets a country may have. An increase in the share of the youth and the working age with simultaneous decrease in the proportion of children lowers dependency ratios and creates an opportunity for economic growth as age structures mature and a larger proportion of the population enters the working age.

North (2014) asserts that population size definitely affects the level of economic development in a country and they state it as a prerequisite of it. The larger the population, the greater the potential productive capacity of a country. Therefore there is significant positive correlation.

This study finds that there is long term positive relationship between equity returns and population size. This can be explained using Chen and Gurdip (1994) and North (2014) who argue that increased population especially of the youth and the working age will increase demand for goods and services besides increasing the investment level in a country. However, Elizabeth *et al* (2010) says that for this population to be productive there needs to be training and education. For Kenya to reap the benefits of its growing middle age population it has to invest in education and technical training to ensure the output generated in the economy is competitive. This way firms will be able to minimize production cost and increase output efficiently and therefore increase returns for investors.

6) Appendix



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